Thesis/
Reports
Nature
Conservancy

Establishment Record for Hideout Mesa Research Natural Area within Manti-La NF

COOP AGREEMENT NATURE CONSERVANCY

INT-97036- CCSA

ESTABLISHMENT RECORD FOR HIDEOUT MESA RESEARCH NATURAL AREA WITHIN MANTI-LA SAL NATIONAL FOREST SAN JUAN COUNTY, UTAH

INTRODUCTION

The La Sal Mountains are a range of intrusive igneous rocks that rise abruptly above the general level of the Colorado Plateau in southeastern Utah. Surrounding the high summits of the peaks, various plateaus and tablelands of sedimentary composition fall off toward the arid canyon country that encircles this island range. The flanks of the range are mantled with coniferous forests, aspen groves, oak-serviceberry shrublands, piñon-juniper woodlands and sagebrush stands. Streams descending steeply from their mountain headwaters have cut deep canyons and gorges in a number of locations around the periphery of the range.

The first human occupancy in the region adjacent to the La Sal Mountains was by prehistoric pueblo people in the first millennium A.D. These people disappeared about 700 years ago. Sparse populations of Utes and Paiutes were in the area when the first white men brought livestock through in the 1820's-30's. Permanent settlement by colonists of the LDS Church was attempted about 30 years later. The first settlement in the Moab area failed in the 1850's, but was re-established in the late 1870's when cattlemen moved into the region.

Settlement has been sustained mostly by reliance on the area's natural resources. Ranching and farming were the basis for much of the settlement and continue to be practiced. Mining activity was at a peak in the 1950's and 60's, but is now at a low ebb. Tourism began to be an important industry for the Moab area in the 1960's, and now in the late 1990's is the dominant segment of the local economy. The La Sal Mountains continue to provide commodity and non-commodity resources that help to sustain life in the region. The non-mineral resources of much of this range are administered by the Manti-La Sal National Forest, created in 1949 by consolidation of the old Manti and La Sal National Forests.

Complementing the multiple use of resources is a need to maintain undisturbed examples of the area's natural diversity. A means of accomplishing this on National Forest lands is through administrative designation of Research Natural Areas (RNAs). These serve to register and protect certain ecosystems as benchmark or reference areas.

The northern end of a small mesa located on the southeastern flank of the La Sal Mountains has been subject to little resource use or development due to its relatively isolated position. Several staff members from the Forest Supervisor's Office and Regional Office visited the site, known as Hideout Mesa, in the mid 1980's. They recognized Hideout Mesa's little-disturbed condition, but did not agree to propose any special designation at that time. The area was again visited in June 1988 by the Forest's Range Conservationist, Bob Thompson, accompanied by the author of this Establishment Record. This inspection documented the presence of old-growth piñon-juniper woodlands and confirmed the general worthiness of Hideout Mesa's northern end as a prospective RNA, though no designation proposal proceeded from the 1988 visit.

A Region-wide initiative was undertaken in the mid 1990's to achieve RNA designation for a handful of sites that had been previously identified as qualified, but for which formal action had not been taken. Hideout Mesa was included in this process, which produced two more site visits with District and Forest staff members (November 1995 and June 1996), and the preparation of a formal reconnaissance report (Tuhy 1997). The opportunity now exists to recognize and protect the values of this site by designating it as the Hideout Mesa Research Natural Area (HMRNA).

The northern end of Hideout Mesa consists entirely of reserved lands of the Manti-La Sal National Forest. It is not within nor does it contain any Congressionally-designated areas such as Wilderness, National Recreation Area or Wild and Scenic River.

Land Management Planning

The Regional Guide for the Intermountain Region (USDA Forest Service 1984) includes policy, general guidance, and Regional planning requirements for RNAs. The more recent Regional Desk Guide (USDA Forest Service 1993a) reiterates that selection and establishment of RNAs shall be a part of the continuing land and resource management planning process. Relevant portions of these Regional documents are included in Appendix A.

The Manti-La Sal National Forest Land and Resource Management Plan ("Forest Plan"; USDA Forest Service 1986b) and Environmental Impact Statement (USDA Forest Service 1986a) contain more-specific policy and guidance for the establishment and management of RNAs on the Forest. Selected materials pertaining to RNAs from these two documents are included in Appendix B.

The Hideout Mesa site was nominated as a candidate RNA as part of the continuing management planning process. However, it is not identified as a candidate RNA in the current Forest Plan. At present, the Forest Plan identifies Hideout Mesa as being within Management Area RNG, where emphasis is on production of forage and cover for domestic livestock and wildlife. As explained later in this Record, however, use of Hideout Mesa by domestic livestock is minimal, and conflicts between livestock and the values that make this site qualified for RNA status are negligible.

The environmental analysis and recommendations necessary for designating the Hideout Mesa site as an RNA are contained within an Environmental Assessment (USDA Forest Service 1998b; Appendix C) and Manti-La Sal National Forest Plan Amendment (USDA Forest Service 1998a; Appendix D). The result of these analyses and the subsequent decision is to change the status of the Hideout Mesa site to Management Area RPI (**R**esearch, **P**rotection and **I**nterpretation), specifically as a Research Natural Area unit in which research and protection are emphasized.

OBJECTIVES

The chief objective of the Hideout Mesa RNA is to preserve and maintain in undisturbed, naturally-functioning condition the biological and genetic diversity present within exemplary terrestrial vegetation types that occur within the area. The best developed among these are coniferous woodlands of two-needle piñon pine and Utah juniper, while fragments of other forest and shrubland types occupy small portions of the site.

Establishment and protection of the HMRNA will further the long-term objective of setting aside at least one example of all the habitat or vegetation community types represented on National Forest lands in Utah or Region 4 (Federal Committee on Ecological Reserves [FCER] 1977). As explained in the following section, the HMRNA contains four vegetation types that would be new to the RNA system within the Northern Canyonlands geographic Section.

The HMRNA will also provide a reasonably accessible reference site for basic, non-manipulative studies of biotic patterns, ecological processes, natural disturbance regimes, and community succession. Left undisturbed by human intrusions, it will afford managers and conservation scientists a benchmark for assessing long-term ecological and geomorphological changes, plus inherent productivity (Passey et al. 1982). Such a benchmark would be especially useful for comparing the effects of resource management techniques and practices on grazed or wooded lands nearby (Johnson 1989).

JUSTIFICATION STATEMENT FOR ESTABLISHMENT OF AREA

An initial estimate of RNA needs in Utah and Nevada found that woodlands indicative of pre-settlement conditions on the Colorado Plateau (including the high laccolithic mountains) were key RNA needs (Van Pelt 1982, Table 26). A few cells of this type have been filled since the date of that initial estimate, via designation of RNAs such as Cliffdweller's Pasture and Mount Peale on the Manti-La Sal National Forest. Many of these key RNA needs remain unfilled, however.

A recent analysis of RNA needs on National Forest lands in Utah (Tuhy 1998) focused on vegetation types as the cells to be targeted for inclusion in the RNA system, segregated according to geographic divisions of the state known as Sections (McNab and Avers 1994). This analysis found that designation of the HMRNA would fill four new cells within the Northern Canyonlands Section. Table 1 shows the specific cells within the HMRNA, and the level of their representation.

Pertinent excerpts from the initial RNA needs estimate (Van Pelt 1982) and from the recent analysis (Tuhy 1998) are included in Appendix E, as documentation of the needed natural diversity elements.

Table 1. Specific cells within the Hideout Mesa RNA, all of which fill unmet RNA cell needs in the Northern Canyonlands Section, and the level of their representation.

CELLS - VEGETATION TYPES	REPRESENTATION MAJOR	MINOR
TALL FOREST COMMUNITIES		
Pinus ponderosa/Arctostaphylos patula (ponderosa pine/greenleaf manzanita)		X
SHORT FOREST, WOODLAND AND SHRUBLAND COMMUNITIES		
Artemisia tridentata ssp. *wyomingensis* (Wyoming big sagebrush)		X
Pinus edulis-Juniperus osteosperma/Cercocarpus montanus (two-needle piñon pine-Utah juniper/birchleaf mountain mahogany)	X	
Pinus edulis-Juniperus osteosperma/Quercus gambelii (two-needle piñon pine-Utah juniper/Gambel oak)		X

Designation of the HMRNA would also add a number of landform and geologic cells to the RNA system, according to the classifications in FCER (1977; pp. 14-19). Because these cell categories are not well-defined within the FCER document, however, a listing of such specific abiotic cells present in the HMRNA is not given here.

Another justification for establishment of the HMRNA involves the use of the area for research. Though no studies are known to be taking place within the area at the present time, the HMRNA could support extensions of existing, localized research focusing on specific communities and their ecotones. Examples of such research include Austin (1987); Brotherson et al. (1984); Brotherson and Brotherson (1981); and Greenwood and Brotherson 1978.

PRINCIPAL DISTINGUISHING FEATURES

The HMRNA comprises the northern end of a small, isolated mesa on the southeastern margin of the La Sal Mountains. The mesa is flanked by drainages on the west and east (Hop Creek and Dry Draw, respectively) that drain southward to the canyon of La Sal Creek, located just off the National Forest. The mesa top is defined by a hard, resistant layer of sandstone that forms a low line of cliffs along the eastern and western edges of the RNA. The center of the mesa contains areas of relatively level topography, dissected by several shallow draws whose sides are short, moderate-gradient slopes.

Most of the HMRNA supports tall, well-developed woodlands of two-needle piñon pine and Utah juniper at elevations close to the upper limit for this broad vegetation zone (Photos 1 and 2). These woodlands contain patches of mountain brush species interspersed with more-open, grassier understory areas. Small fragments of ponderosa pine and Wyoming big sagebrush communities (Photos 3 and 4, respectively) are also present within the piñon-juniper woodland matrix.

The HMRNA bears a few old linear scars from mineral exploration and a few patches of introduced plants, but otherwise the distinguishing features noted above are present in little-altered condition.

LOCATION

The Hideout Mesa RNA is located on the Moab portion of the Moab/Monticello Ranger District of the Manti-La Sal National Forest. [Note: Elsewhere in this Record the "Moab portion of the Moab/Monticello Ranger District" is referred to as the "former Moab Ranger District".] The RNA lies about 9 miles (14 km) east-northeast of La Sal and 30 miles (48 km) southeast of Moab, in northeastern San Juan County (Maps 1-3). Latitude and longitude for the area are 38°21'30" North and 109°05'00" West, respectively. Specifically, the area lies in portions of sections 17, 18, 19 and 20 of T28S R26E, Salt Lake Meridian (Maps 3-4). It is shown on the Ray Mesa (UT-CO) 7.5' topographic quadrangle. Stereo coverage is provided by three aerial photographs, housed at the Moab field office of the Ranger District:

9-14-89 USDA-F 16 614104 689-127 through 689-129

The boundary of the HMRNA (Map 4) follows the generally well-defined rim of the mesa top along its western and eastern sides, and the edge of an old linear mineral-exploration scar along its southern portion. A description of this boundary is provided in Appendix F. The boundary shown on Map 4 encompasses an area of 360 acres (146 ha). Elevation ranges from about 7100 feet (2165 m) along the mesa's rim near the southwestern corner of the site, up to about 7560 feet (2305 m) near the northern tip of the mesa. This represents a vertical relief of about 460 feet (140 m).

The most reliable access to the HMRNA is via Forest Road #072 (the lower Twomile road). This road leads northward off Utah Highway 46 about 7 miles (11 km) east of the town of La Sal, at the location marked as Old LaSal on National Forest maps. Road #072 winds generally northeastward, crossing Twomile Creek, Trough Draw and Hop Creek. This road is suitable for two-wheel drive high-clearance vehicles in good weather, but becomes very slippery when wet. Just east of the crossing of Hop Creek, in the NW¼ of Section 8 (T28S R26E), is the junction of Forest Road #202, a more primitive track on which four-wheel drive is not absolutely required but highly recommended.

Follow Road #202 south to a split below the north end of Hideout Mesa, from which the eastern (left) branch is followed for about 1½ miles (2½ km) further to the junction of a four-wheel-drive road that leads steeply up the eastern slope of Hideout Mesa. This track has a switchback just below the rim and tops out at a point about midway along the mesa's eastern edge, near the southeastern corner of the HMRNA.

Vehicles can be driven on many of the old roads and tracks on the mesa top, though such actions would be discouraged or prohibited in an RNA. Foot travel is easy on the entire mesa top, with only some short steep slopes and occasional brush thickets to hinder progress. There is no water on the mesa top.

AREA BY COVER TYPES

The extent and distribution of vegetation cover types in the HMRNA has been derived from field surveys and subsequent aerial photo interpretation. Several systems for classifying such types are considered, as discussed below.

The Society of American Foresters cover type classification (Eyre 1980) applies to the vast majority of the HMRNA that is covered by coniferous forest and woodlands. The fragments of ponderosa pine forest belong to SAF Type 237: Interior Ponderosa Pine. The extensive woodlands of two-needle piñon pine and Utah juniper belong to SAF Type 239: Pinyon-Juniper. Non-forest shrubland types are not considered in the SAF system.

The classification of potential natural vegetation by Küchler (1966) includes all the vegetation of the HMRNA. The fragments of ponderosa pine correspond to Type 17: Pine-Douglas fir Forest (though Douglas-fir is absent). The piñon-juniper woodlands correspond to Type 21: Juniper-Pinyon Woodland. The fragments of Wyoming big sagebrush correspond to Type 32: Great Basin Sagebrush.

The distribution of SAF cover types and Küchler types in the HMRNA is shown on Map 5. The map legend displays the correspondence ("cross-walking") between these two broad classification schemes for forest types.

According to more-detailed classification work in the region by Youngblood and Mauk (1985), the fragment of ponderosa pine forest at the northern tip of the HMRNA is representative of the *Pinus ponderosa/Arctostaphylos patula* (ponderosa pine/greenleaf manzanita) habitat type. The piñon-juniper woodlands of the HMRNA were described in more detail based on floristic composition observed during the field work done for this Establishment Record (see the **Flora and Communities** subsection).

Table 2 shows the estimated areas of vegetation types defined by the SAF and Küchler systems described above. As on Map 5, the correspondence between these two classification systems for forest types is displayed in the table.

Table 2. Estimated areas of SAF and Küchler types in the Hideout Mesa RNA.

COVER TYPE	TYPE NUMBER SAF (1980)	Küchler (1966)	ESTIMATED AREA Acres	Hectares
Ponderosa pine	237	17	12	5
Piñon-juniper	239	21	345	140
Sagebrush	---	32	3	1
		TOTAL	360	146

PHYSICAL AND CLIMATIC CONDITIONS

The HMRNA comprises roughly the northern half of a small, isolated mesa top on the southeastern margin of the La Sal Mountains. The mesa is flanked by drainages on the west and east (Hop Creek and Dry Draw, respectively) that drain southward to the canyon of La Sal Creek, located just off the National Forest. The mesa's rims are defined by a hard, resistant layer of sandstone that forms a low line of cliffs along the eastern and western edges of the RNA. The portion of the mesa top within the RNA slopes gently toward the south on the whole. The RNA contains areas of relatively level topography, which is dissected in several locations by shallow drainages whose sides form short, moderate-gradient slopes.

The former Moab Ranger District's Soils Report describes the climate in and around the La Sal Mountains. Located on the flanks of these mountains, the HMRNA is subject to relatively cold, snowy winters. Summers are characterized by warm temperatures and scattered but intense thunderstorms. An isohyetal map in the District Soils Report shows that average annual precipitation is about 16 inches (41 cm) in the HMRNA. Another map that depicts length of growing season shows that the HMRNA averages about 100 frost-free days per year.

The National Weather Service (NWS) and USDA Natural Resources Conservation Service (NRCS) monitor climatic data at several installations surrounding the HMRNA. Table 3 shows the name, record length, elevation, and location relative to the HMRNA for two NRCS snotel sites and seven NWS stations in the vicinity. Tables 4-6 contain average climatic data for these sites as posted on the internet. Those who use the HMRNA for research may want to access these internet sites directly for climatic information, rather than relying on the summaries in Tables 4-6. The internet addresses are www.utdmp.utsnow.nrcs.usda.gov for the NRCS snotel site in Utah, ftp://ftp.wcc.nrcs.usda.gov/data/snow/ads/co for the snotel site in Colorado, and wrcc.sage.dri.edu (Western Regional Climate Center) for the NWS stations.

Table 3. Site data for climatic installations in the vicinity of the HMRNA.

SITE NAME	RECORD LENGTH	ELEVATION	LOCATION RELATIVE TO HMRNA
NRCS SNOTEL			
La Sal Mountain (UT)	1980-Present	9850 ft/3000 m	13 miles (21 km) to NW
Columbine Pass (CO)	1987-Present	9140 ft/2785 m	39 miles (62 km) to ENE
NWS STATIONS			
Castle Valley	1978-Present	4720 ft/1440 m	26 miles (42 km) to NW
Castleton	1963-1978	5900 ft/1800 m	21 miles (34 km) to NW
La Sal	1949-1978	6980 ft/2130 m	9 miles (14 km) to WSW
La Sal 2 SE	1978-Present	6720 ft/2050 m	9 miles (14 km) to SW
Moab	1928-Present	4020 ft/1225 m	29 miles (46 km) to NW
Gateway (CO)	1948-Present	4550 ft/1385 m	23 miles (37 km) to NNE
Uravan (CO)	1960-Present	5010 ft/1525 m	19 miles (30 km) to E

Table 4. Average monthly precipitation data for two SNOTEL sites in the vicinity of the HMRNA.

SITE NAME												
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
LA SAL MOUNTAIN												
2.6 in	2.9 in	2.5 in	2.3 in	2.5 in	4.0 in	3.0 in	2.5 in	1.3 in	2.4 in	2.3 in	2.2 in	30.5 in
66 mm	74 mm	64 mm	58 mm	64 mm	102 mm	76 mm	64 mm	33 mm	61 mm	58 mm	56 mm	775 mm
COLUMBINE PASS												
4.3 in	2.8 in	3.6 in	3.7 in	2.7 in	4.3 in	4.4 in	1.6 in	1.9 in	1.8 in	2.7 in	1.3 in	35.1 in
109 mm	71 mm	91 mm	94 mm	69 mm	109 mm	112 mm	41 mm	48 mm	46 mm	69 mm	33 mm	892 mm

Table 5. Average monthly precipitation data for seven NWS sites in the vicinity of the HMRNA.

SITE NAME												
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
CASTLE VALLEY												
0.68 in	0.75 in	1.18 in	1.01 in	1.25 in	0.45 in	0.83 in	0.83 in	0.99 in	1.50 in	1.18 in	0.71 in	11.33 in
17 mm	19 mm	30 mm	26 mm	32 mm	11 mm	21 mm	21 mm	25 mm	38 mm	30 mm	18 mm	288 mm
CASTLETON												
0.60 in	0.55 in	1.03 in	1.39 in	1.15 in	1.14 in	1.50 in	1.41 in	0.95 in	1.73 in	1.23 in	0.94 in	13.62 in
15 mm	14 mm	26 mm	35 mm	29 mm	29 mm	38 mm	36 mm	24 mm	44 mm	31 mm	24 mm	346 mm
LA SAL												
1.01 in	0.76 in	0.70 in	0.93 in	0.96 in	0.77 in	1.29 in	1.50 in	1.06 in	1.92 in	0.90 in	1.05 in	12.84 in
26 mm	19 mm	18 mm	24 mm	24 mm	20 mm	33 mm	38 mm	27 mm	49 mm	23 mm	27 mm	326 mm
LA SAL 2 SE												
0.95 in	0.81 in	1.06 in	0.99 in	1.08 in	0.76 in	1.37 in	1.57 in	1.75 in	1.90 in	1.32 in	0.77 in	14.32 in
24 mm	21 mm	27 mm	25 mm	27 mm	19 mm	35 mm	40 mm	44 mm	48 mm	34 mm	20 mm	364 mm
MOAB												
0.58 in	0.55 in	0.76 in	0.85 in	0.72 in	0.42 in	0.68 in	0.88 in	0.78 in	1.06 in	0.71 in	0.63 in	8.60 in
15 mm	14 mm	19 mm	22 mm	18 mm	11 mm	17 mm	22 mm	20 mm	27 mm	18 mm	16 mm	218 mm
GATEWAY												
0.76 in	0.67 in	1.04 in	1.02 in	0.99 in	0.54 in	1.00 in	1.37 in	1.03 in	1.26 in	0.94 in	0.71 in	11.33 in
19 mm	17 mm	26 mm	26 mm	25 mm	14 mm	25 mm	35 mm	26 mm	32 mm	24 mm	18 mm	288 mm
URAVAN												
0.89 in	0.70 in	1.02 in	1.02 in	1.06 in	0.50 in	1.24 in	1.31 in	1.40 in	1.49 in	1.10 in	0.91 in	12.64 in
23 mm	18 mm	26 mm	26 mm	27 mm	13 mm	31 mm	33 mm	36 mm	38 mm	28 mm	23 mm	321 mm

Table 6. Average monthly maximum and minimum temperatures, and temperature extremes, for seven NWS sites in the vicinity of the HMRNA.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
SITE NAME												
CASTLE VALLEY												
39.0 F	47.5 F	57.6 F	67.3 F	77.0 F	88.5 F	93.9 F	91.2 F	82.2 F	68.8 F	52.2 F	40.7 F	67.2 F
3.9 C	8.6 C	14.2 C	19.6 C	25.0 C	31.4 C	34.4 C	32.9 C	27.9 C	20.4 C	11.2 C	4.8 C	19.6 C
19.0 F	25.2 F	33.1 F	39.9 F	48.7 F	58.0 F	63.0 F	61.6 F	52.3 F	41.0 F	29.4 F	21.4 F	41.1 F
-7.2 C	-3.8 C	0.6 C	4.4 C	9.3 C	14.4 C	17.3 C	16.4 C	11.3 C	5.0 C	-1.4 C	-5.9 C	5.1 C
TEMPERATURE EXTREMES: 107 F/42 C HIGH; -14 F/-26 C LOW												
CASTLETON												
35.5 F	42.9 F	51.2 F	60.7 F	72.8 F	82.9 F	89.6 F	86.9 F	77.8 F	64.0 F	49.6 F	38.5 F	62.8 F
1.9 C	6.1 C	10.7 C	15.9 C	22.7 C	28.3 C	32.0 C	30.5 C	25.4 C	17.8 C	9.8 C	3.6 C	17.1 C
15.4 F	21.3 F	27.8 F	36.0 F	45.9 F	54.3 F	61.1 F	59.0 F	49.3 F	39.2 F	28.3 F	18.1 F	38.0 F
-9.2 C	-5.9 C	-2.3 C	2.2 C	7.7 C	12.4 C	16.2 C	15.0 C	9.6 C	4.0 C	-2.1 C	-7.7 C	3.3 C
TEMPERATURE EXTREMES: 99 F/37 C HIGH; -15 F/-26 C LOW												
LA SAL												
36.1 F	40.6 F	47.7 F	57.0 F	67.5 F	78.4 F	84.9 F	81.6 F	74.1 F	61.4 F	47.5 F	38.2 F	59.6 F
2.3 C	4.8 C	8.7 C	13.9 C	19.7 C	25.8 C	29.4 C	27.6 C	23.4 C	16.3 C	8.6 C	3.4 C	15.3 C
13.6 F	17.2 F	22.7 F	30.3 F	39.4 F	48.3 F	54.9 F	53.0 F	45.1 F	34.0 F	23.8 F	15.4 F	33.2 F
-10.2 C	-8.2 C	-5.2 C	-0.9 C	4.1 C	9.1 C	12.7 C	11.7 C	7.3 C	1.1 C	-4.6 C	-9.2 C	0.7 C
TEMPERATURE EXTREMES: 101 F/38 C HIGH; -16 F/-27 C LOW												
LA SAL 2 SE												
36.7 F	41.4 F	49.6 F	58.7 F	68.3 F	80.2 F	86.4 F	84.6 F	75.8 F	63.7 F	47.7 F	38.5 F	61.0 F
2.6 C	5.2 C	9.8 C	14.8 C	20.2 C	26.8 C	30.2 C	29.2 C	24.3 C	17.6 C	8.7 C	3.6 C	16.1 C
12.2 F	16.9 F	24.4 F	30.2 F	38.1 F	46.4 F	52.9 F	52.5 F	44.1 F	33.2 F	21.7 F	13.8 F	32.2 F
-11.0 C	-8.4 C	-4.2 C	-1.0 C	3.4 C	8.0 C	11.6 C	11.4 C	6.7 C	0.7 C	-5.7 C	-10.1 C	0.1 C
TEMPERATURE EXTREMES: 101 F/38 C HIGH; -25 F/-32 C LOW												

Table 6 (Continued). Average monthly maximum and minimum temperatures, and temperature extremes, for seven NWS sites in the vicinity of the HMRNA.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
SITE NAME												
MOAB												
42.6 F	51.4 F	62.1 F	72.3 F	82.5 F	93.0 F	99.1 F	96.2 F	87.6 F	74.4 F	57.1 F	45.2 F	72.0 F
5.9 C	10.8 C	16.7 C	22.4 C	28.1 C	33.9 C	37.3 C	35.7 C	30.9 C	23.6 C	13.9 C	7.3 C	22.2 C
18.4 F	25.0 F	33.2 F	41.3 F	49.3 F	57.1 F	63.5 F	61.9 F	52.3 F	40.3 F	28.4 F	21.0 F	41.0 F
-7.6 C	-3.9 C	0.7 C	5.2 C	9.6 C	13.9 C	17.5 C	16.6 C	11.3 C	4.6 C	-2.0 C	-6.1 C	5.0 C
TEMPERATURE EXTREMES: 114 F/46 C HIGH; -24 F/-31 C LOW												
GATEWAY												
41.3 F	49.9 F	58.5 F	67.5 F	77.1 F	87.3 F	92.6 F	90.1 F	82.2 F	69.8 F	55.0 F	43.8 F	68.0 F
5.2 C	9.9 C	14.7 C	19.7 C	25.1 C	30.7 C	33.7 C	32.3 C	27.9 C	21.0 C	12.8 C	6.6 C	20.0 C
17.1 F	24.4 F	31.3 F	37.8 F	46.4 F	54.9 F	61.5 F	59.6 F	50.4 F	38.9 F	28.4 F	19.8 F	39.3 F
-8.3 C	-4.2 C	-0.4 C	3.2 C	8.0 C	12.7 C	16.4 C	15.3 C	10.2 C	3.8 C	-2.0 C	-6.8 C	4.2 C
TEMPERATURE EXTREMES: 106 F/41 C HIGH; -28 F/-33 C LOW												
URAVAN												
41.7 F	49.9 F	58.4 F	67.5 F	78.4 F	89.2 F	94.9 F	92.2 F	83.6 F	71.5 F	54.6 F	42.9 F	68.8 F
5.4 C	9.9 C	14.7 C	19.7 C	25.8 C	31.8 C	34.9 C	33.4 C	28.7 C	21.9 C	12.6 C	6.1 C	20.4 C
15.1 F	22.1 F	29.0 F	35.5 F	44.4 F	52.4 F	58.9 F	58.0 F	48.3 F	36.7 F	26.7 F	17.8 F	37.1 F
-9.4 C	-5.5 C	-1.7 C	1.9 C	6.9 C	11.3 C	14.9 C	14.4 C	9.1 C	2.6 C	-2.9 C	-7.9 C	2.8 C
TEMPERATURE EXTREMES: 110 F/43 C HIGH; -23 F/-31 C LOW												

DESCRIPTION OF VALUES

Flora and Communities

Table 7 lists plant species in the HMRNA. Scientific nomenclature follows Welsh et al. (1993), with some commonly-used synonyms included in Table 7 where appropriate. Nomenclature for trees agrees with Little (1979).

Table 7. Plant species in the Hideout Mesa Research Natural Area.

LIFE FORM *Scientific name*[1] [*Synonym*, if any] (common name)	Plant community[2] A	 B	 C
TREES[3]			
Juniperus osteosperma (Utah juniper)	X		X
* *Juniperus scopulorum* (Rocky Mountain juniper)		X	
Pinus edulis (two-needle piñon pine)	X		X
Pinus ponderosa (ponderosa pine)	X	X	
SHRUBS			
Acer glabrum (Rocky Mountain maple)			
Amelanchier utahensis (Utah serviceberry)	X	X	
* *Arctostaphylos patula* (greenleaf manzanita)	X	X	
Artemisia tridentata (big sagebrush)	X		X
Cercocarpus montanus (birchleaf mountain mahogany)	X	X	
Chrysothamnus nauseosus (rubber rabbitbrush)			X
* *Ephedra viridis* (green ephedra)	X		
Gutierrezia sarothrae (broom snakeweed)	X		X
Mahonia repens [*Berberis repens*] (Oregon grape)	X		
* *Pachistima myrsinites* (mountain lover)	X	X	
Purshia tridentata (bitterbrush)	X	X	
Quercus gambelii (Gambel oak)	X	X	
Rosa woodsii (Woods rose)	X		
* *Symphoricarpos oreophilus* (mountain snowberry)	X	X	
GRAMINOIDS			
Agropryon cristatum (crested wheatgrass)	X		X
Bouteloua gracilis (blue grama)	X		X
* *Carex aurea* (golden sedge)	X		
Carex rossii (Ross' sedge)	X	X	X
Elymus elymoides [*Sitanion hystrix*] (squirreltail)	X		
Elymus hispidus [*Agropyron intermedium*] (intermediate wheatgrass)			X
Elymus smithii [*Agropryon smithii*] (western wheatgrass)			X
Elymus spicatus [*Agropyron spicatum*] (bluebunch wheatgrass)			X
Festuca octoflora (sixweeks fescue)			
* *Koeleria macrantha* (junegrass)	X		X
Muhlenbergia montana (mountain muhly)	X	X	
* *Oryzopsis micrantha* (littleseed ricegrass)	X		
Poa fendleriana (muttongrass)	X	X	X
Poa pratensis (Kentucky bluegrass)		X	
Poa secunda (Sandberg bluegrass)	X		
* *Stipa comata* (needle-and-thread)	X	X	X
Stipa hymenoides [*Oryzopsis hymenoides*] (Indian ricegrass)	X		X
FORBS AND SUCCULENTS			
Achillea millefolium (milfoil yarrow)			X
Agoseris glauca (pale agoseris)	X		

Table 7 (Continued). Plant species in the Hideout Mesa Research Natural Area.

LIFE FORM *Scientific name*[1] [*Synonym*, if any] (common name)	Plant community[2] A	 B	 C
FORBS AND SUCCULENTS (CONTINUED)			
* *Andsrosace septentrionalis* (northern rock jasmine)		X	
* *Arabis holboellii* (Holboell's rockcress)	X		
* *Arabis selbyi* (Selby's rockcress)	X		
Arenaria congesta (head sandwort)			
Artemisia biennis (biennial wormwood)			
Artemisia carruthii (Carruth's wormwood)			X
Artemisia dracunculus (tarragon)			X
Artemisia ludoviciana (Louisiana wormwood)			X
* *Astragalus coltonii* var. *moabensis* (Moab milkvetch)	X		
Astragalus tenellus (pulse milkvetch)	X		
* *Balsamorhiza sagittata* (arrowleaf balsamroot)		X	
Calochortus sp. (sego lily)			X
Castilleja linariifolia (linearleaf paintbrush)	X		
Caulanthus crassicaulis (spindlestem)			
Chaenactis douglasii (Douglas dustymaiden)	X		
Collinsia parviflora (blue-eyed Mary)	X		
Comandra umbellata (bastard toadflax)			
Cordylanthus wrightii (Wright's birdsbeak)	X		
* *Cryptantha flavoculata* (yellow-eye cryptanth)	X	X	
* *Cymopterus bulbosus* (onion spring-parsley)		X	
* *Delphinium nuttallianum* (Nelson's larkspur)			
* *Descurainia pinnata* (pinnate tansymustard)	X		
* *Draba cuneifolia* (wedgeleaf)	X	X	
Echinocereus triglochidiatus (claretcup)	X	X	
Erigeron divergens (spreading daisy)	X		
* *Erigeron eatonii* (Eaton's daisy)	X		
* *Erigeron engelmannii* (Engelmann's daisy)		X	
Eriogonum alatum (winged buckwheat)	X	X	
Eriogonum ovalifolium (cushion buckwheat)	X		
Eriogonum racemosum (redroot buckwheat)	X		X
* *Erysimum asperum* (wallflower)	X	X	
Gilia aggregata (scarlet gilia)	X	X	
Gilia congesta (ballhead gilia)	X		
* *Haplopappus armerioides* (thrifty goldenweed)	X	X	
Helianthella microcephala (smallhead sunflower)	X		
Heterotheca villosa (hairy goldenaster)	X	X	
Hymenopappus filifolius (hyaline herb)		X	
* *Hymenoxys acaulis* var. *ivesiana* (Ives' woollybase)	X		X
* *Lappula occidentalis* (western stickseed)		X	
* *Lepidium densiflorum* (densecress)	X		
* *Lesquerella rectipes* (Colorado bladderpod)	X	X	
* *Lithophragma parviflora* (smallflower woodlandstar)		X	
Lithospermum incisum (showy stoneseed)	X		

Table 7 (Continued). Plant species in the Hideout Mesa Research Natural Area.

LIFE FORM *Scientific name*[1] [*Synonym*, if any] (common name)	Plant community[2] A	 B	 C
FORBS AND SUCCULENTS (CONTINUED)			
* *Lomatium foeniculaceum* var. *macdougalii* (desert parsley)	X		
Lupinus argenteus (silvery lupine)	X		X
Lupinus sericeus (silky lupine)	X		
Machaeranthera canescens (hoary aster)	X		X
* *Microsteris gracilis* (little polecat)		X	
Opuntia fragilis (brittle pricklypear)	X		X
Opuntia polyacantha (central pricklypear)	X	X	
Orobanche fasciculata (cluster cancerroot)	X		X
Pediocactus simpsonii (Simpson's footcactus)	X		X
* *Penstemon crandallii* var. *atratus* (La Sal penstemon)	X		
* *Penstemon cyanocaulis* (bluestem penstemon)	X		
Penstemon strictus (Rocky Mountain penstemon)	X		
Petradoria pumila (rock goldenrod)	X	X	
* *Phlox austromontana* (desert phlox)		X	
* *Phlox longifolia* (longleaf phlox)		X	
Phoradendron juniperinum (juniper mistletoe)	X		
* *Physaria newberryi* (Newberry's twinpod)	X		
Polygonum douglasii (Douglas' knotweed)	X		
* *Ranunculus testiculatus* (bur buttercup)	X		
* *Schoencrambe linifolia* (slenderleaf schoencrambe)	X		
* *Senecio integerrimus* (gauge plant)	X		
Sisymbrium altissimum (tumble mustard)	X		
* *Sphaeralcea coccinea* (common globemallow)	X		X
* *Streptanthus cordatus* (twistflower)	X	X	
Swertia radiata [*Frasera speciosa*] (elkweed)	X		
Tragopogon dubius (salsify)	X		X
* *Trifolium gymnocarpon* (Nuttall's clover)	X		
Yucca angustissima (narrowleaf yucca)	X	X	

NOTES:

1. Scientific nomenclature follows: Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins, eds. 1993. A Utah flora, second edition. Brigham Young University, Provo, UT. 986 p.

2. Plant communities:
   A. *Pinus edulis-Juniperus osteosperma* woodlands.
   B. *Pinus ponderosa* communities.
   C. *Artemisia tridentata*/grass parks.

3. Nomenclature for trees follows: Little, E.L., Jr. 1979. Checklist of United States trees. USDA Forest Service Agricultural Handbook 541. 375 p.

* Collected and deposited in regional herbaria.

The HMRNA contains no plants federally listed as endangered or threatened, nor any plants considered sensitive by Region Four of the USDA Forest Service. At one time *Penstemon crandallii* var. *atratus* (La Sal penstemon) was thought to be rare, but sufficient numbers and locations are now known for it so that it is not considered as sensitive.

Three types of plant communities defined by existing vegetation were identified in the HMRNA (see Table 7). These are described in more detail below.

A. *Pinus edulis-Juniperus osteosperma* (two-needle piñon pine-Utah juniper) communities.

A woodland or pygmy forest of piñon pine and juniper covers most of the HMRNA. As a general forest type, piñon-juniper stands occupy more area in the Intermountain region than all other forest types combined (Cronquist et al., 1972; p. 126). On Hideout Mesa, the particular tree species present in these woodlands are *Pinus edulis* and *Juniperus osteosperma* (Photos 1 and 2).

The woodlands of the HMRNA exhibit a mix of size classes, including healthy regeneration, of the piñon and juniper trees. Because the top of Hideout Mesa lies near the upper-elevational limit of this broad vegetation zone, many of the piñon pine trees there are much larger -- up to 40 feet (12 m) tall and 20+ inches (51+ cm) dbh -- than typical *Pinus edulis* trees at lower elevations. Several expressions of diversity within these woodlands were observed, based on vegetation structure, species composition and soil surface characteristics, as described in the following two paragraphs.

Piñon-juniper communities near the edges of the mesa top, and on sideslopes of incised draws more toward the center, contain appreciable amounts of *Quercus gambelii* in the understory. These communities have a brushy physiognomy that tends to hinder foot travel somewhat. They have been labeled as a *Pinus edulis-Juniperus osteosperma/Quercus gambelii/Poa secunda-Poa fendleriana* community type (Bob Thompson, Manti-La Sal NF, personal communication).

Piñon-juniper stands on more level portions of the mesa's interior tend to have understories that are less or not at all brushy. Where the trees are less dense, three tall shrub species -- *Amelanchier utahensis*, *Cercocarpus montanus* and *Quercus gambelii* -- form patches in the understory. Where the trees are more dense, the understory has a more grassy appearance imparted by *Poa fendleriana* plus other herbaceous species (Photo 2). The *Poa* tends to be locally more abundant in microsites with smoother, less-eroded ground surfaces. Sites with more evidence of local soil erosion (i.e. pedestalled plants, rills, more surface rock) are characterized by abundance of *Petradoria pumila* and *Carex rossii*. All together, these communities have been labeled as a *Pinus edulis-Juniperus osteosperma/Cercocarpus montanus/Poa fendleriana* community type (Bob Thompson, Manti-La Sal NF, personal communication).

All of these piñon-juniper woodland communities are notable for the presence and local abundance of *Poa fendleriana*, a grass that is highly palatable to livestock. Also, ground surfaces in these woodlands support many patches of well-developed cryptobiotic crust.

B. *Pinus ponderosa* (ponderosa pine) communities.

Fragments of what appear to be two different types of ponderosa pine communities occur in the HMRNA, as described in the following two paragraphs.

The extreme northern tip of the mesa top supports a very small area of the *Pinus ponderosa/ Arctostaphylos patula* habitat type described by Youngblood and Mauk (1985). It appears as a small stand of scattered mature ponderosa pine trees above an understory of patchy shrubs, in which *Arctostaphylos patula* is most abundant and conspicuous (Photo 3). *Heterotheca villosa* and *Carex rossii* are relatively common among the herbaceous species present in this community.

Sides of the north-south trending drainage that runs through the south-central portion of the HMRNA are vegetated with a fairly open stand of ponderosa pine trees. The understory contains a rather diverse mix of species, in which *Arctostaphylos patula* is scarce or absent. The fragmentary nature of this stand makes it difficult to assign a reliable identification of habitat type from Youngblood and Mauk (1985).

C. *Artemisia tridentata* (big sagebrush)/grass parks.

There are two small openings termed "parks" located within the piñon-juniper woodland of the mesa top. The larger of these parks lies near the head of the main north-south drainage through the south-central part of the RNA, in a location where the landform is more of a shallow swale than a well-defined canyon. The smaller park also occupies a shallow swale, about ¼ mile (400 m) west-northwest of the larger park.

The larger park supports a shrubland of *Artemisia tridentata* ssp. *wyomingensis* above a grassy understory that contains abundant *Stipa comata* and *Koeleria macrantha*, plus moderate amounts of *Bouteloua gracilis* and *Poa fendleriana* (Photo 4). Small- to medium-sized piñon and juniper trees are encroaching into this larger park from the surrounding woodland communities.

The smaller park contains an abundance of the same grasses, but very few shrubs. It also supports several introduced, exotic plant species, but these have not spread very far into surrounding communities. There are a few trees within the smaller park, but many of these (plus some trees around its margin) are dead or dying from unknown causes.

Fauna

None of the Endangered or Threatened wildlife species found on the former Moab Ranger District are expected to occur in the HMRNA. The absence of water, willows, sheer cliffs, and cliffs associated with riparian areas and large ponderosa pine trees makes it unlikely that southwestern willow flycatcher (*Empidonax traillii extimus*), peregrine falcon (*Falco peregrinus*) and Mexican spotted owl (*Strix occidentalis lucida*) would be present.

Several wildlife species considered Sensitive by Region Four of the USDA Forest Service may be present in the HMRNA. The Flammulated owl (*Otus flammeolus*), Three-toed woodpecker (*Picoides tridactylus*) and Northern goshawk (*Accipiter gentilis*) generally occupy mixed forests of spruce, fir, pine and/or aspen on the former Moab Ranger District. These birds may occur in the HMRNA as temporary visitors passing through to more suitable habitat that does exist nearby. The spotted bat (*Euderma maculatum*) is known to occupy piñon-juniper woodlands, but is generally associated with water sources and high cliffs. The absence of water and high cliffs in the HMRNA makes presence of spotted bats unlikely there. Townsend's big-eared bat (*Corynorhinus townsendi*) has been known to occupy piñon-juniper woodlands and may even use tree cavities for daytime roosting. However, their roosting is most often associated with mine shafts, caves and rock outcrops. Appropriate habitat for Townsend's big-eared bat does exist in and around the HMRNA.

The HMRNA supports several species identified as Management Indicator Species (MIS) in the Forest Plan (USDA Forest Service 1986b; page II-31), including Rocky Mountain mule deer (*Odocoileus hemionus*), North American elk (*Cervus elaphus*), Blue grouse (*Dendragapus obscurus*) and Golden eagle (*Aquila chrysaetos*).

Rocky Mountain mule deer forage on the shrub species found in the HMRNA, but are limited by the absence of water. The Utah Division of Wildlife Resources considers Hideout Mesa to be high value winter/transitional range for deer, which move through the drier areas to more suitable winter range at lower elevations. Numerous deer pellets were seen during RNA field inspection trips to Hideout Mesa.

North American elk use Hideout Mesa, which is considered as critical winter range for them by the Utah Division of Wildlife Resources. Piñon and juniper trees of the RNA provide thermal cover, while grasses beneath the trees and along streams below the mesa top provide forage for the elk.

Blue grouse have not been documented on Hideout Mesa, but they could occur as a temproary visitor passing through to mixed-conifer and/or oakbrush communities near water. The HMRNA would not be considered as high-value habitat for Blue grouse.

No Golden eagle nests have been located on Hideout Mesa, but appropriate habitat for them does exist there. Piñon and juniper trees of the RNA could be used as perch sites while eagles forage for rabbits and rodents in openings within the trees or in stream bottoms below the mesa.

Other wildlife species of interest that may occur in the HMRNA include turkey (*Meleagris gallopavo*), mountain lion (*Felis concolor*), Abert's squirrel (*Sciurus aberti*), and black bear (*Ursus americanus*). Turkeys may pass through the area, but would more likely occupy the stream bottoms below the mesa. An abundance of mountain lions are known to occupy the southern portion of the former Moab Ranger District. Lions maintain large home ranges, of which Hideout Mesa would be a small part. Abert's squirrels are better known as inhabitants of the Monticello portion of the Ranger District. However, a population of them was established in the Buckeye Reservoir area just inside Colorado, with sightings now known across the southern benches of the former Moab Ranger District. Abert's squirrels prefer ponderosa pine forests for nesting and foraging, although they have been found occupying piñon trees. As with turkeys, Abert's squirrels would be expected to pass through rather than reside on Hideout Mesa. Black bear are known to use Hideout Mesa as part of their ranges. Signs of black bear (scat, and claw marks on trees) were seen during several RNA field inspection trips to the HMRNA.

An abbreviated list of other animals likely to be present in the HMRNA is presented below:

BIRDS	
Bushtit	*Psaltriparus minimus*
White-breasted nuthatch	*Sitta caroliniensis*
Bewick's wren	*Thryomanes bewickii*
Rock wren	*Salpinctes obsoletus*
Blue-gray gnatcatcher	*Polioptila caerulea*
Black-throated gray warbler	*Dendroica nigrescens*
MAMMALS	
Desert cottontail rabbit	*Sylvilagus audubonii*
White-tailed jackrabbit	*Lepus townsendii*
Rock squirrel	*Spermophilus variegatus*
Northern pocket gopher	*Thomomys talpoides*
Ord kangaroo rat	*Dipodomys ordii*
Pinyon mouse	*Peromyscus truei*
Desert woodrat	*Neotoma lepida*
Coyote	*Canis latrans*
Red fox	*Vulpes fulva*
REPTILES	
Gopher snake	*Pituophis melanoleucus*
Yellow-bellied racer	*Coluber constrictor*
Western rattlesnake	*Crotalus viridis*
Side-blotched lizard	*Uta stansburiana*
Short-horned lizard	*Phrynosoma douglassii*

Geology

The geologic events that formed and shaped the present-day La Sal Mountains and their surroundings are intertwined with the long-term history of the entire Colorado Plateau. Following is a brief synopsis of this geologic history, mostly summarized from Barnes (1993).

From the late Precambrian Era to the late Cretaceous Period, an interval of more than half a billion years, the incipient Colorado Plateau was a low-lying, relatively flat area. The region fluctuated many times between being inundated by shallow seas and being low coastal plains with little relief. The climate varied from tropical to subtropical, humid to arid. Many layers of marine, coastal, fresh-water and aeolian deposits accumulated during this time. This thick crust of sediments largely protected the region from the effects of major tectonic events that were to follow.

The first such event was an eastward-traveling crustal pressure that began in late Cretaceous time and lasted well into the Tertiary Period. Within the incipient Colorado Plateau, this pressure produced several uplifts (Circle Cliffs, San Rafael Swell) and basins (Uinta, Kaiparowits). The region was still not far above sea level, and had few elevational extremes. Gentle topography and arid climate combined to place limits on the effectiveness of water erosion processes.

A period of volcanism began in the region toward the end of the Eocene Epoch. This activity was most widespread and intense around the perimeter of the Colorado Plateau during the Oligocene and early Miocene Epochs. The thick sedimentary crust prevented significant extrusive activity within the Colorado Plateau itself. However, magma did flow upward and intrude subsurface sedimentary strata at several locations, one of which became the La Sal Mountains.

About 24 million years ago, in early Miocene time, the roots of the present-day La Sal Mountains were formed by three closely-spaced vertical upwellings of magma, termed stocks. Magma from the stocks flowed horizontally into incompetent or weak sedimentary strata, primarily mudstones and shales. These horizontal intrusions formed a series of laccoliths radiating outward from each central stock, bulging overlying sedimentary strata upward into domes. These subsurface igneous intrusions were superimposed on an existing set of northwest-southeast-trending salt-anticline structural features in the region.

Following the emplacement of these igneous intrusions, the land's surface was probably one of high, rounded hills. Erosion continued at a very slow rate through the remainder of the Miocene Epoch, except on the domes above the igneous intrusions where greater vertical relief increased erosion somewhat.

The proto-La Sals remained as rounded highlands until a major regionwide uplift event began about 10 million years ago, in the early Pliocene Epoch. This event raised the entire Colorado Plateau more than a mile higher than it had been. As the region became higher its climate became wetter, especially in the highlands above the igneous intrusions. This greatly accelerated the effectiveness and rate of water erosion throughout the region, resulting in the labyrinth of canyons for which the Colorado Plateau is famous. Also in relatively recent times, salt bodies underlying the linear anticlines of the region were largely eroded out. This caused these features to collapse and form the series of northwest-southeast trending valleys that are so prominent in the region, among which the Paradox Valley is closest to the HMRNA.

The general southward slope of the top of Hideout Mesa therefore appears to be a result of surface deformation caused by igneous intrusions that formed the La Sal Mountains, coupled with proximity to the southwestern limb of the anticline that became the Paradox Valley.

The top of Hideout Mesa is comprised of two Cretaceous-age sedimentary strata, as mapped by Hintze and Stokes (1964). The upper of these is the Dakota Sandstone, which forms the low cliffs that define the mesa top, and also covers most of the interior of the RNA. Doelling (1993) describes the Dakota as yellow-gray to brown sandstone, conglomeratic sandstone and conglomerate, interbedded with gray mudstone, carbonaceous shale, coal and claystone. Underlying the Dakota Sandstone is the Burro Canyon Formation, which is exposed around the mesa top's margins and in the base of the deepest draw through the central part of the HMRNA. Doelling (1993) describes the Burro Canyon Formation as consisting of brown to gray sandstone, gritstone, conglomerate, and limestone and olive-green to gray mudstone. Slopes beneath the top of Hideout Mesa, outside the boundary of the HMRNA, are outcrops of the Morrison Formation, including the Brushy Basin (upper) and Salt Wash (lower) Members. The latter is one of the chief uranium-bearing strata on the Colorado Plateau.

Soils

Soils of the area that includes Hideout Mesa have been mapped and described by the USDA Soil Conservation Service (1991). The HMRNA is covered by two soil mapping units, described briefly below. The soil survey document provides additional information about the properties, management and suggested uses of these soils of the HMRNA.

Mapping Unit 102: Waas very fine sandy loam, 2 to 8 percent slopes. This unit occurs on the mostly-level top of Hideout Mesa, and covers virtually the entire RNA. The Waas soils are very deep and well-drained, having been formed in aeolian deposits derived predominantly from sandstone.

Mapping Unit 39: Herm-Tomasaki-Falcon complex, 25 to 65 percent slopes. This unit comprises the westward-sloping terrain along the western edge of the mesa top, and is of very small areal extent within the HMRNA. Thirty percent of the unit is Herm stony loam, 25 to 50 percent slopes. Herm soils are very deep and well-drained; they are formed in colluvium derived predominantly from sandstone and shale. Twenty-five percent of the unit is Tomasaki loam, 25 to 65 percent slopes. Tomasaki soils are very deep and well-drained; they are formed in colluvium derived predominantly from shale and sandstone. Twenty percent of the unit is Falcon gravelly sandy loam, 25 to 65 percent slopes. Falcon soils are shallow and well-drained; they are formed in slopewash and residuum derived predominantly from sandstone and shale.

Lands

The Hideout Mesa RNA is entirely reserved National Forest System land with no encumbrances or withdrawals.

Cultural

The general region of Hideout Mesa contains evidence of occupancy by prehistoric people and later by Ute/Paiute Indians. A small cultural resource survey (160 ac/65 ha) was done in 1980 on the northern end of Hideout Mesa in association with prospective mineral activities. This survey found one prehistoric site, a lithic scatter. The next mesa to the west had quite a few prehistoric sites, but these were poorly documented. Based on the presence of these adjacent sites, the HMRNA could contain prehistoric sites with a few features of temporary camps, such as hearths and storage pits. The HMRNA was not seen to contain any structures or cultural artifacts of more recent, anglo occupation (other than several mineral exploration scars), though a thorough survey might reveal the remains of ranching or other activities.

Other

The Hideout Mesa RNA contains no other known features of local (or wider) importance.

IMPACTS AND POSSIBLE CONFLICTS

Mineral Resources

Impacts and possible conflicts with respect to several major categories of mineral resources are each addressed in their own subsection below.

Leasable Minerals: oil and gas, coal, oil-impregnated rocks, and geothermal resources.

The general area of Hideout Mesa has a moderate potential for the presence of oil and gas resources. According to Gloyn et al. (1995), it is in a part of San Juan County underlain by several oil reservoirs that have the potential to become productive: the Cane Creek Shale Play and Paradox Play of the Pennsylvanian Paradox Formation, the Mississippian Leadville Limestone, and the McCracken Sandstone of the Devonian Elbert Formation. National Forest minerals staff people surmise that any good structural traps at depth would probably be located to the east of Hideout Mesa.

The actual oil and gas development potential within the HMRNA itself is probably low. Neither Gloyn et al. (1995) nor Clem and Brown (1984) show any existing oil or gas fields near the HMRNA. The latter authors also show no occurrences of oil and gas in T28S R26E (within which the RNA lies). The closest drilling activities to the HMRNA shown by Clem and Brown have been a dry hole in Section 36 of T28S R25E, and gas shows in Sections 5 and 17 of T29S R26E.

Information on oil and gas leases in this region is maintained by the Bureau of Land Management (BLM). The oil and gas leasing plat for T28S R26E (dated 10/5/98) shows section 17 within a tract labeled "OG COMP". Sections 18, 19 and 20 are not shown to be in an identified oil/gas leasing tract.

The single existing oil and gas tract referenced above is open to leasing under standard terms and Forest-wide stipulations as provided in the Forest Plan (USDA Forest Service 1986b). In the vicinity of the HMRNA, the only restriction is that slopes greater than 35% are not permissible for surface occupancy. Slopes of this steepness are located off the edges of the mesa top, around the margin of the HMRNA; there may be small areas within the RNA itself subject to this stipulation, but the majority of the area has much gentler slopes. No modification of these leasing conditions was made by the subsequent oil and gas leasing Environmental Impact Statement for the Forest (USDA Forest Service 1993b).

Gloyn et al. (1995) report that coal resources of San Juan County occur primarily in the Dakota Sandstone. This stratum forms the surface in much of the HMRNA, and Plate 5 of Gloyn et al. shows the area of Hideout Mesa as a potential coal deposit. Available data indicate that the primary areas of thick, potentially economic deposits of coal in San Juan County lie east of Monticello, but that marketing factors such as product quality and lack of adequate rail transportation hinder the development even of economic coal deposits such as these. Gloyn et al. note that there is no current coal production or exploration activity in the coal fields of San Juan County, nor any known plans for coal exploration and development.

Gloyn et al. (1995) report that the area surrounding Hideout Mesa contains no known or potential oil-impregnated rocks or geothermal resources.

BLM records show no coal or geothermal leasing plats for T28S R26E, so it is assumed that no leases of these types exist in or anywhere near the HMRNA.

Locatable Minerals: Uranium-vanadium and metallic resources.

Elevatorski (1978) shows that Hideout Mesa is located in the La Sal Creek area of the Paradox uranium/vanadium mining district. Deposits and mines are clustered in a long, narrow mineral belt

parallel to and above La Sal Creek, on both sides of the Utah-Colorado border. The largest ore bodies in this area are in the thick Salt Wash Member of the Morrison Formation, which is located below the top of Hideout Mesa.

The top of Hideout Mesa has seen considerable prospecting and exploration activity for uranium and vanadium. The majority of this activity, however, has taken place on the southern half of the mesa which is outside the HMRNA. Evidences of this activity include old linear scars through the woodlands (for taking drill samples) and old claim marker posts (wood and metal) in various places.

Examination of known prospects and mines on and near Hideout Mesa by Forest minerals staff people finds a potential of high to very high for small, high-grade deposits of uranium, and moderate to high for vanadium. Obvious low-grade uranium ore was noted in dumps south of Hideout Mesa, and several large producing mines were located within 1-2 miles (1.6-3.2 km) of the HMRNA boundary. These mines, such as the Blue Cap, Black Hat, Vanadium Queen, and Firefly, are on the bench above the north side of La Sal Creek, below the southern end of Hideout Mesa. The closest mining activity to the HMRNA itself shown by Elevatorski (1978) is the Hop Creek deposit, located down in the valley of Hop Creek below and west of the RNA, near the boundary of Sections 18 and 19 (T28S R26E).

The main impact of mineral activity on Hideout Mesa would be the need to perform closely spaced, near-surface exploratory drilling due to the nature of the ore occurrence. Access roads and drill pads would have major surface-disturbing effects. At the current spot prices for uranium, however, the potential of this happening is low. No upward trend in uranium prices is foreseen in the short term future, given the present worldwide oversupply. While the vanadium market has recently become very volatile, the occurrence of vanadium seen at the HMRNA was very low. Any profitable ore located would be mined from outside the RNA, so the impacts would be restricted to exploration activities.

Gloyn et al. (1995) write that at a market price of $10 per pound of concentrate, uranium requirements of U.S. utilities are now being met by low-cost (solution mining) domestic producers and foreign imports. They note that much higher prices for uranium and vanadium will be required before the uranium-vanadium mining industry in San Juan County is again viable. Chenoweth (1990) estimates that a price of $20 to $30 per pound U_3O_8 would be required.

With respect to metallic resources, Gloyn et al. (1995) report that occurrences of gold, copper and manganese in San Juan County have proved to be small and uneconomic (except for copper deposits along the Lisbon Valley fault, well away from the HMRNA). They further write that lead, zinc, copper, molybdenum and several other metals are found associated with sedimentary-hosted uranium-vanadium deposits, but (with the exception of copper) all of these metals occur in quantities too small to be considered even as by-products of uranium-vanadium mining. Plate 8 of Gloyn et al. (1995) shows no known occurrences or potential for metallic mineral resources in or near the HMRNA.

Information on mining claims for locatable minerals is maintained by the BLM. The number and status of mining claims in the four sections that overlap the HMRNA are shown below, according to BLM geographic index microfiche dated 5/18/98. All of these claims are lapsed or no longer active; that is, all are shown as "Case Closed" in the microfiche file. It is possible, however, for claims to exist without being shown in the BLM records.

Section (T28S R26E)	Lapsed Claims	Active Claims
17	71	0
18	85	0
19	67	0
20	64	0

Industrial Rock and Mineral Resources.

Text and plates in Gloyn et al. (1995) show the area of the HMRNA to have little or no value for presence of industrial rock and mineral resources such as sand and gravel, bentonite, limestone, gemstones, ornamental stone, building stone, gypsum, humate, and others. Saline resources such as potash and salt are present in the Paradox Formation beneath much of San Juan County, but at Hideout Mesa they are buried beneath more than 4000 feet (1220 m) of overburden, greatly diminishing the potential for their development.

Grazing

Hideout Mesa is located within the South Paradox cattle allotment, for which the permit is held by Redd Ranches (Paul Redd & Lee Chadwick). Permitted use on the entire allotment is 181 cow-calf pairs from June 1 to November 30, for a total of 1104 head-months. More specifically, the RNA lies in the Hop Creek unit within the Hop Creek division of the allotment. The two units of the Hop Creek division (Hop Creek and Paradox) are managed in a deferred grazing system. The Hop Creek unit is used in a four-year rotation with two years grazing in the fall, followed by two years grazing in the early summer. Due to the complexity of the permittees' operation, numbers vary from 38 to 310 head-months on the Hop Creek unit. Usually, the Hop Creek unit is used as a corridor between winter range (on adjacent BLM-administered lands) and summer range (on State trust lands).

Though cattle are not physically excluded from the reaching the HMRNA, minimal grazing occurs there for several reasons. First, the area is mostly covered by a piñon-juniper woodland beneath which herbaceous forage species are scarce, especially compared with the drainage bottoms on either side of the mesa. Second, the RNA contains few, if any, reliable sources of water. Third, the mesa top is not readily accessible. Infrequent incidental grazing use in the RNA would only happen when cattle drift up the steep vehicle track onto the mesa top from Dry Draw to the east.

The Forest considers the vegetation of the HMRNA to be unsuitable range for cattle grazing, and AUMs (carrying capacity) have not been allocated for the area. Therefore, designation of the HMRNA would result in no reduction in cattle numbers or adjustments to the term grazing permit on the South Paradox allotment.

The Forest has no plans for water developments or other range improvements within the area of the HMRNA, and thus there will be no effort to move cattle into the area purposely. There are no existing fences in the RNA, none are needed, and no change in management is necessary in lieu of fencing. Livestock grazing will not be used as a management tool to maintain vegetation communities in the HMRNA. Maintenance of the current grazing situation on the South Paradox allotment will result in an acceptable level of casual or incidental livestock use that can be tolerated within the HMRNA.

Given the situation and conditions described above, establishment of the HMRNA poses no conflicts with grazing management on the South Paradox cattle allotment.

Timber

The total forested area of the HMRNA is about 12 acres (5 ha), considering that the vast majority of the area is occupied by "non-forest" piñon-juniper woodlands. The RNA is not included in those areas designated by the Forest Plan (USDA Forest Service 1986b) to be managed under the timber emphasis prescription (TBR), nor would the RNA's minimal "forest" land be considered as available, capable or suitable for timber management under the Forest Plan. Productivity of the area's small ponderosa pine stands is generally less than 20 ft^3/acre/year (1.4 m^3/ha/yr). Although the mesa top has relatively gentle topography, access is rough and generally limited. The primary potential use of the area with respect to

wood products would be for fuelwood or fenceposts, though other locations exist with easier access and more readily available materials of these types. Designation of the HMRNA would not affect (i.e. would withdraw no values from) the current timber management base as defined by the Forest Plan.

Watershed Values

The HMRNA contains no perennial water sources, wetlands or riparian habitats. It does contain parts of two southward-trending ephemeral drainage courses that would carry water during periods of snowmelt or intense summer storms. The RNA does not appear to be a major source of sediments to surrounding drainages, given its gentle topography and moderately well-vegetated condition. RNA designation should have no impact on the watershed properties of this area.

Recreation Values

Use of Hideout Mesa for recreation is generally limited by its relative remoteness and lack of easy access. Though exact figures are not available, Forest recreation staff people estimate that the HMRNA receives less than 100 recreation visitors per year, mostly hunters and adventurers. No obvious signs of dispersed recreational use such as fire rings, campsites, trash, etc., were seen in the HMRNA during field inventories. The area has little to attract recreational visitors that cannot be found and experienced in more accessible locations.

The little-disturbed character and relative remoteness of the HMRNA, coupled with an increasing demand for semi-primitive recreation opportunities, could result in increased recreational use in the area. However, the Forest will not be marketing, providing easier access, or otherwise drawing recreational attention to Hideout Mesa. No change in current recreation management direction or activity at Hideout Mesa is anticipated to result from RNA designation. The only consequence anticipated is that designation will preclude permitted use of the HMRNA by Outfitter and Guide operations, which increasingly are seeking primitive adventure-type opportunities. Anticipated future recreational use levels are expected to be at low enough levels so as not to adversely affect the values for which the HMRNA was designated.

Wildlife and Plant Values

Designation and management of the HMRNA will maintain suitable habitat for special-status animals that are known or likely to occur in the area.

Special Management Area Values

The HMRNA does not contain or overlap with any Congressionally-designated areas.

Transportation Plans

The generally north-south-trending vehicle track just in from the eastern edge of the HMRNA is shown on the Forest Travel Map as being open yearlong to all vehicles. Motorized use of this route will be discouraged, and future opportunity to close this route may be taken if it arises. The Forest Travel Map also shows that Hideout Mesa is within an area that is closed to over-snow vehicles.

There are no transportation plans on the Manti-La Sal National Forest that would have direct adverse effects on the HMRNA. Conversely, designation of the HMRNA should have no effect on the Manti-La Sal National Forest transportation system. The vehicle track near the eastern margin of the RNA dead-ends on the mesa top, and does not provide access to other portions of the Forest.

MANAGEMENT PRESCRIPTION

In order to meet and maintain the objectives for which the HMRNA is established (see the **OBJECTIVES** section of this Record), various management standards and prescriptions will apply to the area. General standards for RNA protection and management are contained in the Forest Service Manual, Section 4063.3. More specific management prescriptions for RNAs on the Manti-La Sal National Forest are contained within the direction for Management Unit RPI, which appears on pages III-83 through III-87 of the Forest Plan (USDA Forest Service 1986b); these pages are included in Appendix B of this Record. [Note: Because Management Unit RPI is not limited to Research Natural Areas, some of the Unit RPI stipulations are not applicable to RNAs.] A synopsis of the management standards and prescriptions for the HMRNA, drawn from these sources, is provided below.

Emphasis for use of the HMRNA is on research, study, observations, monitoring, and educational activities that are nondestructive and nonmanipulative. Management of the HMRNA will be directed toward maintenance of unmodified conditions and natural ecological processes, as a source to compare with manipulated conditions outside of the area. Human activities that directly or indirectly modify ecological processes will not be permitted within the HMRNA.

Use of the HMRNA by scientists and educators is strongly encouraged. Cooperation with the Rocky Mountain Research Station is encouraged in order to accomplish research objectives. Special-use permits or cooperative agreements will be used to authorize and document scientific activity. Any public use that contributes to impairment of research or educational values will be discouraged or prohibited. Surface resource conditions will be protected to prevent alteration of research projects. Guidelines for scientific and educational use of the HMRNA are contained in FSM 4063.33.

Logging activities, harvest of woodland products, fuelwood gathering, Christmas tree gathering, and direct habitat manipulation for wildlife are prohibited within the HMRNA. The District and Forest should show the HMRNA as a closed area on firewood and Christmas tree cutting maps that are distributed to the public.

Livestock grazing will not be used as a management tool to maintain vegetation communities in the HMRNA. Maintenance of the current grazing situation on the South Paradox cattle allotment, within which the HMRNA lies, will result in an acceptable level of casual or incidental livestock use that can be tolerated within the HMRNA. Construction of range improvements is prohibited within the HMRNA, and other management actions will not be taken to encourage livestock usage at greater than current levels within or toward the vicinity of the HMRNA. Overnight pasturing of recreational pack stock is not permitted within the HMRNA.

Placement of recreation facilities and establishment of permanent camps are prohibited within the HMRNA. Use of the HMRNA by Outfitter and Guide operations will not be permitted. Other recreational use of the HMRNA is not expressly prohibited, but such use will not be encouraged so that the scientific and educational values of the area can be emphasized. The effects of recreational uses (if any) that occur within the HMRNA will be evaluated periodically. Any such uses that are found to be threatening or interfering with the objectives for which the HMRNA was established will be prohibited. Indicators of unacceptable degradation include the appearance of new vehicle or foot trails, creation of campsites, campfire rings, unnatural erosion patterns, and other indications of significant recreational use.

No new roads, trails, fences, signs, buildings, administrative structures or other physical improvements will be permitted within the HMRNA, unless they are necessary for research or study purposes or otherwise contribute to the objectives or protection of the area. Motorized use of the existing vehicle route along the eastern rim of the HMRNA will be discouraged, and future opportunity to close this route may be taken if it arises. The Forest Plan allows for the presence of instrumentation to measure

precipitation and climate variables needed for research study purposes; FSM 4063.31 contains procedures for authorizing temporary physical improvements.

Water impoundment structures, water developments and watershed protection activities are prohibited within the HMRNA.

Special closures may be used when necessary to protect the HMRNA from actual or potential damage from public use, or to prohibit uses that are incompatible with the area's objectives, according to provisions of 36 CFR 261.50 (see also FSM 4063.3.6).

Fire hazard will not be reduced within the HMRNA. Natural fires within the HMRNA will be allowed to burn only within the parameters of an approved fire plan, and only under a prescription designed to accomplish the objectives of the area. Until such a plan has been approved by the Regional Forester in consultation with the Rocky Mountain Research Station Director, fires will be suppressed using means that will cause minimal damage to the HMRNA. Use of heavy equipment in suppression efforts is strongly discouraged, and should be used only as a last resort. Use of chemical fire retardants in the HMRNA likewise is strongly discouraged. Fire-caused debris will be left for natural decay, and post-fire rehabilitation is not recommended. If such rehabilitation must be done, as in cases of extreme flood or erosion hazards to people or property outside the HMRNA, then only seeding with locally adapted ecotypes of indigenous species should be utilized.

No actions will be taken against endemic insects, diseases, wild plants or animals in the HMRNA, unless the Regional Forester and Station Director deem such actions necessary to protect the features for which the HMRNA was established or to protect adjacent resources.

Introduction or spread of exotic plant or animal species into the HMRNA is prohibited, and precautions will be taken to avoid such introductions. If re-seeding is needed following a fire (as mentioned above), then the seed mix will not contain non-native plant species. If pack stock are determined to be a vector for introduction of non-native plant species, then weed-free feed requirements will be implemented. Insofar as is practical, measures will be taken to control or eradicate existing or new occurrences of exotic plant or animal species from the HMRNA, particularly those that readily invade native communities and/or alter natural ecological conditions. Where pest management or noxious weed control activities are necessary within the HMRNA, they will be as specific as possible against target organisms, and will induce minimal impacts to natural values and other components of the ecosystem.

The Forest Plan (page III-86) calls for withdrawal of the HMRNA from mineral entry if such action is needed to protect the area's values. Mineral withdrawal would be in conformance with section 204 of the Federal Land Policy and Management Act of 1976 (90 Stat. 2743, 43 U.S.C. 1701; FSM 2761). Failure to achieve such a withdrawal will not be a deterrent to the continued RNA status of the Hideout Mesa area (FSM 4063.2).

Mineral lease applications, permits and licenses within the HMRNA will be reviewed and processed in a timely fashion, recommending to the Bureau of Land Management such measures and stipulations as necessary to protect surface resources. New leases within the HMRNA will include the stipulation for No Surface Occupancy. Seismic and prospecting activities are prohibited in the HMRNA.

Utility corridors are excluded from the HMRNA.

Vegetation Management

As mentioned above in the **MANAGEMENT PRESCRIPTION** section, domestic livestock grazing will not be used as a management tool to maintain vegetation communities in the HMRNA.

Fire plays an important functional role in several of the woodland and shrubland communities represented in the HMRNA. Over time, fire suppression alters the "natural" or pre-settlement fire regime in these communities, and leads to changes in their structure and function. In the long term, continued fire suppression may even convert these communities into types whose response to fire is entirely unpredictable.

Therefore, inventory, monitoring and research should emphasize the role of fire as a natural process governing these woodland and shrubland communities, and evaluate the risk of continued wholesale fire suppression. Such knowledge should be incorporated into an approved fire plan for that portion of the Forest in which the HMRNA lies, and allow for conditions under which certain naturally-ignited fires may be allowed to burn within the HMRNA. Such a plan will identify those parts of the HMRNA that are allocated for prescribed non-suppression of naturally ignited fires, and those parts that are reserved for permanent suppression of fire (per FSM 4063.41.5.j(1)).

Monitoring

To ensure that only authorized use is occurring and to determine if any threats may be imminent, the HMRNA should be visited annually or biennially by Forest Service personnel or a cooperative partner. A stewardship monitoring module prepared by the Natural Areas Program Office in Missoula MT is available for use in documenting the results of such general monitoring visits.

Establishment of permanent monitoring plots is encouraged within the HMRNA. These would provide information required to manage effectively and protect the area over time. Long-term ecological monitoring in RNAs will make significant contributions to understanding of how ecosystem patterns and processes change over time.

ADMINISTRATION, RECORDS AND PROTECTION

Administration, records and protection of the HMRNA are the ultimate responsibility of the Director of the Rocky Mountain Research Station. The Station Director, in consultation with the Forest Supervisor, Manti-La Sal National Forest, and District Ranger, Moab/Monticello Ranger District, will approve all management plans and oversee and coordinate approved research. The Forest Supervisor will execute approved management plans for the HMRNA and administer, manage and protect the area. The District Ranger has responsibility for direct administration, protection and management of the HMRNA in accordance with this Establishment Record, Forest Plan management direction, and any subsequent management plans for the HMRNA.

Requests to conduct research within the HMRNA are referred to the Station Director, who will be responsible for any studies or research conducted. The Station Director will evaluate research proposals, and will coordinate the activity with the District Ranger prior to the initiation of any project. All plant and animal specimens collected in the course of research conducted in the HMRNA will be deposited with the Monte L. Bean Life Science Museum and Herbarium at Brigham Young University, and/or with federal agency herbaria and museums approved by the Station Director.

Records for the HMRNA will be maintained in the following offices:

Intermountain Region, Ogden, UT
Manti-La Sal National Forest, Price, UT
Moab/Monticello Ranger District, Monticello, UT
Rocky Mountain Research Station, Ogden, UT

ARCHIVING

The Research Natural Area Coordinator at the Intermountain Regional Office, Ogden, UT, will be responsible for maintaining the HMRNA research data files, including studies conducted in the HMRNA, lists of plant and animal species and plant communities occurring within the HMRNA, and lists of herbarium and museum specimens collected. Descriptive data from the HMRNA will also be stored in the computerized natural areas database maintained by the Utah Natural Heritage Program in Salt Lake City, UT.

REFERENCES

Austin, D.D. 1987. Plant community changes within a mature pinyon-juniper woodland. Great Basin Naturalist 47(1):96-99.

Barnes, F.A. 1993. Geology of the Moab area. Canyon Country Publications, Moab, UT. 264 p.

Brotherson, J.D., D.L. Anderson, and L.A. Szyska. 1984. Habitat relations of *Cercocarpus montanus* (true mountain mahogany) in central Utah. Journal of Range Management 37(4):321-324.

Brotherson, J.D., and W.T. Brotherson. 1981. Grazing impacts on the sagebrush communities of central Utah. Great Basin Naturalist 41(3):335-340.

Chenoweth, W.L. 1990. Lisbon Valley, Utah's premier uranium area, a summary of exploration and ore production. Open File Report 188, Utah Geological Survey, Salt Lake City, UT. 46 p.

Clem, K.M., and K.W. Brown. 1984. Petroleum resources of the Paradox Basin. Bulletin 119, Utah Geological Survey, Salt Lake City, UT. 162 p.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. Intermountain flora, Volume one. Hafner Publishing Company, Inc., New York. 270 p.

Doelling, H.H. 1993. Interim geologic map of the Moab 30 x 60 minute quadrangle, Grand County Utah. Open-File Report 287, Utah Geological Survey, Salt Lake City, UT. 14 p. + Map and Figures.

Elevatorski, E.A. 1978. Uranium guidebook for the Paradox Basin, Utah-Colorado. MINOBRAS, Dana Point, CA. 95 p.

Eyre, F.H., ed. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 p.

Federal Committee on Ecological Reserves [FCER]. 1977. A directory of research natural areas on federal lands of the United States of America. USDA Forest Service, Washington, DC. 280 p.

Gloyn, R.W., C.D. Morgan, D.E. Tabet, R.E. Blackett, B.T. Tripp, and M. Lowe. 1995. Mineral, energy, and ground-water resources of San Juan County, Utah. Special Study 86, Utah Geological Survey, Salt Lake City, UT. 39 p.

Greenwood, L.R., and J.D. Brotherson. 1978. Ecological relationships between pinyon-juniper and true mountain mahogany stands in the Uinta Basin, Utah. Journal of Range Management 31(3):164-167.

Hintze, L.F., and W.L. Stokes. 1964. Geologic map of Utah, southeastern quarter. Scale 1:250,000. Utah State Land Board, Salt Lake City, UT.

Johnson, K.L., ed. 1989. Rangeland resources of Utah. Cooperative Extension Service, Utah State University, Logan, UT. 103 p.

Küchler, A.W. 1966. Potential natural vegetation. U.S. Geological Survey, Washington, DC.

Little, E.L., Jr. 1979. Checklist of United States trees. USDA Forest Service Agricultural Handbook 541. 375 p.

McNab, W.H., and P.E. Avers, Compilers. 1994. Ecological subregions of the United States: Section descriptions. USDA Forest Service Administrative Publication WO-WSA-5, Washington, DC. 267 p.

Passey, H.B., V.K. Hugie, E.W. Williams, and D.E. Ball. 1982. Relationships between soil, plant community, and climate on rangelands of the Intermountain West. USDA Technical Bulletin 1669. 123 p.

Tuhy, J.S. 1997. Reconnaissance report: Hideout Mesa Research Natural Area. Unpublished report to USDA Forest Service Intermountain RNA Committee and Manti-La Sal National Forest. 12 p.

Tuhy, J.S. 1998. Research Natural Area needs on National Forest lands in Utah. Unpublished report to USDA Forest Service Intermountain Region, Ogden, UT. 19 p.

USDA Forest Service. 1984. Regional guide for the Intermountain Region. Forest Service, Intermountain Region, Ogden, UT. 125 p.

USDA Forest Service 1986a. Final environmental impact statement [for the Manti-La Sal National Forest land and resource management plan]. Manti-La Sal National Forest, Price, UT.

USDA Forest Service. 1986b. Land and resource management plan, Manti-La Sal National Forest. Manti-La Sal National Forest, Price, UT.

USDA Forest Service. 1993a. Desk guide: Bridge to revision. Forest Service, Intermountain Region, Ogden, UT.

USDA Forest Service. 1993b. Final environmental impact statement for oil and gas leasing on lands administered by the Manti-La Sal National Forest. Manti-La Sal National Forest, Price, UT.

USDA Forest Service. 1998a. Amendment #98/11/20, Manti-La Sal National Forest land and resource management plan, November 1998. Manti-La Sal National Forest, Price, UT.

USDA Forest Service. 1998b. Environmental assessment for the designation of five Research Natural Areas on three National Forests in the State of Utah. USDA Forest Service Intermountain Region, Ogden, UT. 18 p. + Maps.

USDA Soil Conservation Service. 1991. Soil survey of Canyonlands area, Utah, parts of Grand and San Juan Counties. 293 p. + maps.

Van Pelt, N.S. 1982. Research natural area needs in Nevada and Utah: A first estimate. Western Regional Office, The Nature Conservancy, San Francisco, CA. 153 p.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins, eds. 1993. A Utah flora, second edition. Brigham Young University, Provo, UT. 986 p.

Youngblood, A.P., and R.L. Mauk. 1985. Coniferous forest habitat types of central and southern Utah. USDA Forest Service General Technical Report INT-187. Intermountain Forest and Range Experiment Station, Ogden, UT. 89 p.